



# Test Report: MSP-200-48

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200W Single Output Medical Type

## ■ DESIGN VERIFY TEST

Output Function Test  
Input Function Test  
Protection Function Test  
Control Function Test  
Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test  
E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1 : 250 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 88 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 40.8 V ~ 55.2 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	38.55 V ~ 58.39 V / 230 VAC 38.52 V ~ 58.38 V / 115 VAC	P
3	OUTPUT VOLTAGE TOLERANCE	V1 : 1 %~ -1 % (Max)	I/P : 100 VAC / 264 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.11 %~ -0.11 %	P
4	LINE REGULATION	V1 : 0.2 %~ -0.2 % (Max)	I/P : 100VAC ~ 264 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~ 0 %	P
5	LOAD REGULATION	V1 : 0.5% ~ -0.5 % (Max)	I/P : 230 VAC O/P : FULL -MIN LOAD Ta : 25°C	V1 : 0.11 %~ -0.11 %	P
6	SET UP TIME	230VAC : 1000 ms (Max) 115VAC : 2500 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 128 ms 115VAC/ 256 ms	P
7	RISE TIME	230VAC : 50 ms (Max) 115VAC : 50 ms (Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 8 ms 115VAC/ 8 ms	P
8	HOLD UP TIME	230VAC : 16 ms (TYP) 115VAC : 16 ms (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 42 ms 115VAC/ 35 ms	P
9	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : < 5 %	P
10	DYNAMIC LOAD	V1 : 4800 mVp-p	I/P : 230 VAC O/P : FULL /Min LOAD 90%DUTY/ 1KHZ Ta : 25°C	825 mVp-p	P

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	85VAC~264 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	69 V~264V	P
			I/P : LOW-LINE -3V= 82 V HIGH-LINE+15%=300 V O/P : FULL/MIN LOAD ON : 30 Sec . OFF : 30 Sec 10MIN ( AC POWER ON/OFF NO DAMAGE )	TEST : OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 85 VAC ~ 264 VAC O/P : FULL -MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.961 / 230 VAC	P
		0.99 / 115 VAC(TYP)		PF= 0.997 / 115 VAC	
4	EFFICIENCY	89 % (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	89.83 %	P
5	INPUT CURRENT	230V/ 1.1 A (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 1.02 A/ 230 VAC	P
		115V/ 2.2 A (TYP)		I = 2.01 A/ 115 VAC	
6	INRUSH CURRENT	230V/ 70 A (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 60 A/ 230 VAC	P
		115V/ 35 A(TYP) COLD START		I = 30 A/ 115 VAC	
7	NO LOAD POWER CONSUMPTION	< 0.5W	I/P : 240 VAC O/P : NO LOAD RC+/RC- SHORT Ta : 25°C	0.33 W	P
8	LEAKAGE CURRENT	< 300 uA/ for earth leakage current	I/P: 264 VAC O/P:Min LOAD Ta:25°C	L-FG 270 uA N-FG 270 uA	P
		< 100 uA/ for touch leakage current	I/P: 264 VAC O/P:Min LOAD Ta:25°C	L-V+ 92 uA L-V- 92 uA N-V+ 92 uA N-V- 92 uA	

**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	105 %- 135 %	I/P : 230 VAC I/P : 115 VAC O/P : TESTING Ta : 25°C	123 %/ 230 VAC 123 %/ 115 VAC Constant current limiting recovers automatically after fault condition is removed	P
2	OVER VOLTAGE PROTECTION	CH1 : 57.6 V~ 67.2 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	63.29 V/ 230 VAC 63.32 V/ 115 VAC Shut down Re- power ON	P
3	OVER TEMPERATURE PROTECTION (optional)	SPEC : TSW1 : 95 ± 5°C O.T.P. detect on heatsink of power transistor TSW2 : 105 ± 5°C O.T.P. detect on main power output choke NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage , recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 264 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant current limiting	P

**CONTROL FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	REMOTE CONTROL	Rc+ / Rc- 0 V~ 0.8 V POWER OFF 4 V~ 10V POWER ON	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	0 V~2.7 V POWER ON 2.8 V~10 V POWER OFF	P
2	5V STANDBY	5VSB : 5V@0.3A ; tolerance ±5%, ripple : 50mVp-p(max)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	5VSB : 4.914 V / 0.3A Ripple : 13 mV	P

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated : 2SK4106 12A/500V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 404 V (2) 456 V (3) 250 V	P
2	Diode Peak Voltage	Q101 Rated : FMX-12SL 10A/200V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 195 V (2) 190 V (3) 131 V	P
3	Input Capacitor Voltage	C5 Rated : 100u/400V 105°C KMG	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 392 V (2) 392 V (3) 390 V	P
4	Control IC Voltage Test	U1 Rated : FAN4801NY 10V~30V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 16.3 V (2) 13.8 V (3) 16.6 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : IRFP460A 20A/500V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 404 V (2) 406 V (3) 400 V	P

■ SAFETY & E.M.C. TEST

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P: 4 KVAC/min I/P-FG: 2 KVAC/min O/P-FG: 0.5 KVAC/min	I/P-O/P: 4.2KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 0.6 KVAC/min Ta:25°C	I/P-O/P: 5.21 mA I/P-FG: 4.28 mA O/P-FG: 3.83 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ I/P-FG : 500VDC>100MΩ O/P-FG : 500VDC>100MΩ	I/P-O/P : 500 VDC I/P-FG : 500 VDC O/P-FG : 500 VDC Ta : 25°C /70%RH	I/P-O/P : 30 GΩ I/P-FG : 30 GΩ O/P-FG : 27.8 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	9 mΩ	P

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A CLASS D	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS	P
2	CONDUCTION	EN55011 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab	P
3	RADIATION	EN55011 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 INDUSTRY AIR:8KV / Contact:6KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																																																														
1	TEMPERATURE RISE TEST	MODEL : MSP-200-24 1. ROOM AMBIENT BURN-IN : 3 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.3 °C 2. HIGH AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 43.8 °C			P																																																																																																														
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta= 26.3 °C</th> <th>HIGH AMBIENT Ta= 43.8 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF2</td><td>TR548-R2 R-22/14/8B(MA100) 8.8m</td><td>51.3°C</td><td>67.4°C</td></tr> <tr><td>2</td><td>BD1</td><td>6A/800V SILICON GBU608</td><td>75.9°C</td><td>90.7°C</td></tr> <tr><td>3</td><td>L3</td><td>TR872 CS234125E14 1.16u HRP-200</td><td>71.0°C</td><td>86.1°C</td></tr> <tr><td>4</td><td>Q1</td><td>IRFP460A 20A/500V TO247</td><td>65.0°C</td><td>80.3°C</td></tr> <tr><td>5</td><td>C5</td><td>100u/400V 105°C 18*25 KMG</td><td>62.2°C</td><td>76.4°C</td></tr> <tr><td>6</td><td>Q3</td><td>2SK4106 12A/500V TO220F</td><td>73.0°C</td><td>90.0°C</td></tr> <tr><td>7</td><td>T2</td><td>TR435-R4 R13x7x5A MA070 MS-300</td><td>63.4°C</td><td>77.1°C</td></tr> <tr><td>8</td><td>T1</td><td>TF2033 EER-35 HRP-200-24 B</td><td>84.7°C</td><td>100.9°C</td></tr> <tr><td>9</td><td>C150</td><td>100u/25V L5Kh 6.3*11 KY</td><td>64.1°C</td><td>79.4°C</td></tr> <tr><td>10</td><td>C61</td><td>100u/25V L5Kh 6.3*11 KY</td><td>64.5°C</td><td>78.2°C</td></tr> <tr><td>11</td><td>D1</td><td>BYC8-600 8A/600V TO220</td><td>64.2°C</td><td>79.9°C</td></tr> <tr><td>12</td><td>Q101</td><td>FME-220B 20A/150V TO220F</td><td>72.4°C</td><td>89.2°C</td></tr> <tr><td>13</td><td>L100</td><td>TR878 Ku090125-2*2 162u</td><td>84.3°C</td><td>99.3°C</td></tr> <tr><td>14</td><td>C105</td><td>1000u/35V L10Kh 12.5*25 KY</td><td>66.7°C</td><td>83.9°C</td></tr> <tr><td>15</td><td>T900</td><td>TF1593-R2</td><td>85.4°C</td><td>104.1°C</td></tr> <tr><td>16</td><td>ZD900</td><td>TVS ST02D-200 AX078 T-52mm</td><td>70.6°C</td><td>87.0°C</td></tr> <tr><td>17</td><td>U900</td><td>TNY275PN DIP-8C</td><td>77.9°C</td><td>97.1°C</td></tr> <tr><td>18</td><td>C911</td><td>22u/50V UL10Kh 5*11KY</td><td>75.5°C</td><td>92.8°C</td></tr> <tr><td>19</td><td>C956</td><td>47u/50V L5Kh 6.3*11 YXF</td><td>72.3°C</td><td>89.8°C</td></tr> <tr><td>20</td><td>TSW1</td><td>ST-22W-R0 170mm</td><td>82.0°C</td><td>98.9°C</td></tr> <tr><td>21</td><td>TSW2</td><td>ST-22W-R0 170mm</td><td>82.3°C</td><td>98.0°C</td></tr> </tbody> </table>	NO	Position		P/N	ROOM AMBIENT Ta= 26.3 °C	HIGH AMBIENT Ta= 43.8 °C	1	LF2	TR548-R2 R-22/14/8B(MA100) 8.8m	51.3°C	67.4°C	2	BD1	6A/800V SILICON GBU608	75.9°C	90.7°C	3	L3	TR872 CS234125E14 1.16u HRP-200	71.0°C	86.1°C	4	Q1	IRFP460A 20A/500V TO247	65.0°C	80.3°C	5	C5	100u/400V 105°C 18*25 KMG	62.2°C	76.4°C	6	Q3	2SK4106 12A/500V TO220F	73.0°C	90.0°C	7	T2	TR435-R4 R13x7x5A MA070 MS-300	63.4°C	77.1°C	8	T1	TF2033 EER-35 HRP-200-24 B	84.7°C	100.9°C	9	C150	100u/25V L5Kh 6.3*11 KY	64.1°C	79.4°C	10	C61	100u/25V L5Kh 6.3*11 KY	64.5°C	78.2°C	11	D1	BYC8-600 8A/600V TO220	64.2°C	79.9°C	12	Q101	FME-220B 20A/150V TO220F	72.4°C	89.2°C	13	L100	TR878 Ku090125-2*2 162u	84.3°C	99.3°C	14	C105	1000u/35V L10Kh 12.5*25 KY	66.7°C	83.9°C	15	T900	TF1593-R2	85.4°C	104.1°C	16	ZD900	TVS ST02D-200 AX078 T-52mm	70.6°C	87.0°C	17	U900	TNY275PN DIP-8C	77.9°C	97.1°C	18	C911	22u/50V UL10Kh 5*11KY	75.5°C	92.8°C	19	C956	47u/50V L5Kh 6.3*11 YXF	72.3°C	89.8°C	20	TSW1	ST-22W-R0 170mm	82.0°C	98.9°C	21	TSW2	ST-22W-R0 170mm	82.3°C	98.0°C		
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 122 % LOAD Ta : 25°C	TEST : OK	P																																																																																																														
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -40 °C	TEST : OK	P																																																																																																														
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 40°C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																														
5	TEMPERATURE COEFFICIENT	± 0.04 %(0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.006 %(0-50°C)	P																																																																																																														
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		OK	P																																																																																																														

7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -40°C~ +45°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load	OK	P
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10-500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 5G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
9	CAPACITOR LIFE CYCLE	MSP-200-24:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40 °C LIFE TIME	(1) 185942HRS (2) 67159HRS (3) 111374HRS	P
10	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 189.1K HRS		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2012/6/14	PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023